UTILITY MODERNIZATION

**Glendale Water & Power
Takes a Bold Next Step**

City of
Glendale
Water & Power

Gwp

Your Trusted Community Utility

Glendale Water & Power
### Takes a Bold Next Step

INTRODUCTION

In today's world, where everyone seems to have a smart phone, tablet, personal computer, and HDTV, with the use of electric vehicles and home solar electric generation systems starting to grow, and in a region where water is becoming increasingly scarce, it is interesting to note that until very recently, Glendale's electric and water systems were essentially the same as was installed over 100 years ago.

In 2008, it was becoming increasingly clear to City Leaders that Glendale would have to modernize our 100 plus year old electric and water system if we were to be ready to meet the challenges of the 21st century and continue to provide the reliable and cost effective electric and water service our citizens have come to expect. With this in mind, Glendale Water & Power (GWP) set out to become one of the first municipal utilities to simultaneously implement electric and water Smart Grid technology and processes that would transform our utility and provide a tremendous positive impact on customer satisfaction and overall utility operations.

One of the biggest projects in Glendale Water & Power's history included the implementation of a new Advanced Metering Infrastructure (AMI), distribution monitoring and control systems for power and water, enterprise data management systems and a significant capability to interact with customers.

DOE AND CEC GRANTS

In an effort to help fund the $70 million cost of the program, GWP applied for and received $21 million in grants from the U.S. Department of Energy (DOE), and the California Energy Commission (CEC) - $20 million from the DOE, and $1 million from the CEC. The DOE grant was highly competitive, with hundreds of utilities across the nation making application. Glendale Water & Power was one of 100 utilities to receive a DOE grant, and was the first in the nation to sign the grant contract and start the program. The DOE grant provided GWP with $20 million to support the modernization program. This was, and continues to be, the largest grant ever received by the City of Glendale.

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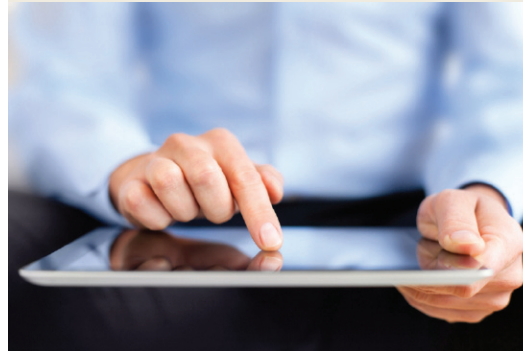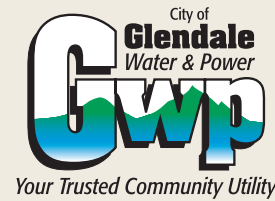
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PROGRAM TECHNOLOGIES

This multi-year program includes the installation of:

- Digital meters with large data storage capabilities and two-way communications hardware and software:
  - Electric meters with wireless access capability to allow for remote service disconnect and re-connect
  - Water meters with leak detection and tamper alarm functionality.
  - A wide area network to allow two-way communications between utility operations and each meter in our service territory.
  - A communications backbone for distribution automation, direct load control, distributed generation, demand response, and new customer directed programs and service options that allow customers to take control of energy and water usage through access to real or near real time consumption information.
  - Meter Data Management System to integrate meter data with the utility's billing, customer information system, outage management, load control systems, and other digital systems.
  - A premise gateway that communicates to a Home Area Network (HAN) to promote demand response, energy and water conservation information, and dynamic pricing options.
- New innovative energy efficiency, load management, and demand response programs based on critical peak pricing, time of use, and dynamic pricing programs.
- Deployment and integration of distributed resources and generation, including renewable resources.
- Development and incorporation of demand response, demand-side resources, and energy-efficiency resources.
- Deployment of near real-time, automated, interactive technologies that optimize the physical operation of 'smart' appliances and consumer devices for metering, communications concerning grid operations and status, and distribution automation.
- Deployment and integration of advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning.
- Improve reliability, security, and efficiency of the electric grid by increased use of digital information and controls technology.
- Dynamic optimization of grid operations and resources, with full cyber-security.

FRAMEWORK FOR A SMARTER CITY

Glendale Water & Power recognized the need for a comprehensive technical road-map for the future integration of Smart Grid systems. The utility made a commitment to the mutual cooperation between city operations to ensure that the new technology investments would work together to provide city-wide benefits. The road-map was envisioned to reflect the technology principle of implementing best available commercial, off-the-shelf software and integrating standards rather than attempting to build custom application solutions.

The principle of "buy and integrate" vs. "develop and customize" is much better suited for Glendale given the availability of technical and staff resources and the desired time frame to implement the systems. An architectural road-map was developed to achieve these objectives. It was designed to ensure Glendale has a consistent, secure and reliable set of technologies and interactions. The advancement will make information available when and how it is needed by GWP operational and city enterprise systems, employees, customers an stakeholders. Both the water and electric divisions along with the City's IT department participated in developing the architecture to ensure that the architecture would bridge the current state of processes and systems to the future statue of the integrated utility.

Beyond utility operations and customer services, other city services will benefit from a modernized utility. The City of Glendale's, public works, police and fire services will be able to share data. The adoption of standard information models is increasing interoperability among a highly diversified application portfolio. In the future, the city will be able to manage the sharing of operational information with outside agencies as well. For example, future integration may include integration with the Department of Homeland Security, allowing for multi-jurisdictional emergency operations management and coordination.

Through the combination of a pragmatic approach to enterprise architecture, a strategic acquisition of technology, a tactical augmentation on critical skill sets, and the adoption of a sustainable program governance framework, the City of Glendale is well on its way to meeting the Smart Grid challenge – and doing it in an effective and cost efficient manner. Ultimately, Glendale's foresight in making an enterprise-wide investment in systems integration technology, standards and new processes is laying the foundation for a Smart City, whose benefits extend in practical ways to all of its consumers.

The road-map known as the GWP Smart Grid Architecture, is an overall guide for the acquisition and implementation of all systems and integrations. It was designed to ensure Glendale has a consistent, secure and reliable set of technologies and interactions.

Customers need to easily understand the new technology, how it affects them, benefits, future rate plans and in-home displays. The program's success hinges on the creation of an effective dialogue with customers to understand and meet their needs and address their concerns while helping them to enjoy the full benefit afforded by the new system.

CUSTOMER EDUCATION & OUTREACH

Launching a turnkey modernization program requires a heavy emphasis on education and outreach. The smartest part of the smart grid has to be the customer if the project is to yield all of the benefits possible. Customers need to easily understand the new technology, how it affects them, benefits, future rate plans and in-home displays. The program's success hinges on the creation of an effective dialogue with customers to understand and meet their needs and address their concerns while helping them to enjoy the full benefit afforded by the new system.

Customer surveys conducted by GWP at the beginning of the program showed that most of our customers had positive views about the Smart Grid, yet few claimed to completely understand it. Subsequent surveys have shown an increase in understanding while retaining positive sentiment.

During the proof-of-concept phase, GWP tested several communication plans. It developed an introductory letter, a frequently asked questions (FAQs) brochure, reminder postcards and door hangers. The local media and televised city council meetings, the utility's newsletter, local newspaper and various blogs have been covering the coming of the digital meters to Glendale. Press releases were issued on a monthly basis about the DOE grant, the proof-of-concept phase and installations plans. The utility also held five community meetings throughout the city to let customers know about the upcoming installations and show them the new meters.

Also during the proof-of-concept phase, GWP held meetings with a wide array of stakeholders — service clubs, large-business customers, small-business customers, realtors' associations, homeowners' associations, nonprofit organizations, chambers of commerce and different city department executives — to inform them of the move to the smart grid and how it would benefit the utility and the community. Then an advisory group, comprised of Glendale residents who represent a wide array of stakeholders, was formed and started meeting on a monthly basis to discuss rollout plans, implementation, customer education and outreach.

In the interest of successfully communicating with all of its customers, GWP provided printed and electronic information in the four languages most commonly spoken in Glendale, on its web site and at events. Utility Partners of America (UPA), the firm that installed the meters, had their customer service center available to 24 hours a day to answer questions and address concerns. UPA's call center supports 31 languages, which ensures that all GWP customers will have their questions and concerns adequately addressed.

SECURITY & PRIVACY

Glendale Water & Power takes customer data privacy and the physical security of the grid very seriously. It is known that one widely publicized instance of any type of cyber-attack that may shut off power or compromise consumer information can cause skepticism among our consumers on grid modernization. The more GWP is open and transparent with their customers about the steps they are taking to ensure the security of customer data and the reliability of the grid, the more likely the customers will trust that utility is managing their data and infrastructure appropriately.

Glendale Water & Power will provide a security infrastructure consistent with applicable standards and industry best practices to protect GWP's cyber assets, business objectives, and its customers to the highest degree possible, while implementing the AMI Initiative. From the beginning of the AMI initiative, GWP developed a privacy policy and shared it with customers. Customer service representatives were also extensively trained on customer data management and security. The utility has installed software and systems that monitor and scan vulnerable threats similar to the Department of Defense. Glendale Water & Power continues to test and monitor its security system continuously.

Cyber security is an ongoing process requiring continuous monitoring and improvements, constant vigilance and a review of threats as they emerge. The utility is committed to enacting cyber security in this manner for any initiative moving forward.

PROJECTED BENEFITS

A recent study by Utiliworks and the Speigler Group estimates that the GWP Modernization Program can provide net positive value and an annual internal rate of return of 11.5% over the life of the program by realizing the following program benefits from the technologies the program will ultimately deploy:

• Digital Communicating Meters – this new technology makes it possible for GWP to automate its billing systems and support operational functions and benefits:

– Meter Reading – reduces labor costs associated with meter reading function

– Read-To-Bill – reduces the time between bill read and bill payment

– Tamper – enhances billing on potential tamper accounts

– Call Center – enables call center operators with real-time data to increase efficiency

– Special Reads – uses the real-time ability of advanced meters to reduce the number of special read requests

– Fleet – reduces the need for meter reading fleet

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Glendale Water & Power manages an electric service territory of 85,358 electric meters and 33,744 water meters with an all time peak load of 353 MW.

– Emissions – automation function reduces carbon emissions associated with meter reading vehicles, connections and energy demand management and voltage monitoring.

• Connect/Disconnect – uses an automated process to turn on or off service without the need to dispatch a serviceman

– Labor Reduction – reduces labor currently required to perform connect/disconnect functions

• Energy Demand Management – using advanced meters as a vehicle to support customer-facing energy management programs:

– Customer Revenue – allows for the evaluation of the potential impacts to system revenue based on customer participation

– Peak Capacity Reduction – uses energy management programs to reduce system peak

• Substation Monitoring – using sensors at distribution substations to support additional functionality

– Measurement Labor – reducing labor costs associated with substation monitoring through the use of automated systems

– Avoided Capacity – using distribution automation functions to support reductions in annual capital outlays for feeder and substation expense

• Voltage Monitoring – using automated sensors, reclosers, and capacitors to reduce operating costs

– Loss Reduction – reducing line losses through system automation

– Capacity Reduction – reducing capital expenditures for distribution upgrades

– Nominal Voltage Optimization – using volt/var program to effectively reduce end of feeder voltage on a dynamic basis where called for

• Fault Detection – using automated sensors and communications devices to dynamically monitor the grid and respond to system events

– Feeder Outages – reduce labor costs associated with feeder related outages

– Distribution Element Failure Detection – proactively address potential system issues in order to reduce overtime in the event of distribution element failures

– Transformer Optimization – using system data to pro-actively identify system issues and extend the life of distribution transformers

– Conductor Repair – reducing the costs associated with conductor splicing

PROJECTED BENEFITS (continued)

– Outage Management – responding to outages more effectively and turning service to customers back on more rapidly

– General Outages – reducing labor costs associated with system outages

• Water System Savings

– Conservation – using sensors to monitor system leaks

– Water Conservation – reducing the amount of water lost through system leaks

– Emissions – reducing carbon emissions by reducing overall water resource requirements

– SCADA – automating supervisory control functions in support of water operations

– Capital Maintenance – reducing annual capital maintenance costs through enhanced system efficiency

– Electric Charge – reducing electric charge on water operations through enhanced system efficiency

PROJECT SUCCESSES TO DATE – TO DATE THE FOLLOWING ASPECTS OF THE PROJECT HAVE BEEN COMPLETED

• Foundational Citywide Tropos Wi-Fi System has been installed – This allows for a wide area network to allow two-way communication between the utility and each meter in our service territory

• Fiber has been extended to North Glendale – This provides for faster and more reliable communications between City buildings such as Fire Stations and Libraries

• 100% of electric and water digital meters installed – Meters have large data storage capabilities and two communications enabled. Electric meters with remotely controllable switches to allow for remote service disconnect and reconnect and water meters with leak detection and tamper alarm functionality

• Meter Data Management System is installed and fully operational – Integrates meter data with the utility's billing and customer service options that allow customers to take control of energy and water costs through access to real or near real time consumption information.

• Billing 100% of our residential and commercial billing cycles – More efficient billing system providing Customer Service staff with real time energy and water usage information to better assist customers.

• Electric and Water Reads rates continue above 99% - More efficient reads that helps the utility detect losses and bill more efficiently.

• AMI-Operations Team established, adequately manned and fully operational

• Utilizing internal engineers and employees from the Utility Operations Center installing and maintaining equipment

Key Targeted Benefits

• *Reduced meter reading costs*

• *Reduced operating and maintenance costs*

• *Provide customers access to interval data, load management, demand response, critical peak pricing, time of use and dynamic rate program*

• *Deferred investment in distribution capacity expansion*

• *Improved electric reliability and power quality*

• *Reduced costs from equipment failures and distribution line losses*

• *Reduced truck fleet fuel usage*

• *Reduced greenhouse gas and criteria pollutant emissions*

• *Rapid water leak detection*

• *Outage management*

• *Renewable generation integration*

Utility Modernization…

• *Impacts the entire organization*

• *Has the technology that changes the customer-utility relationship; it is a cultural shift in the utility industry.*

• *Is a community effort not just a utility effort*

• *Puts customers first and their choices first. Makes utilities understand that customers do not all have the same needs and preferences.*

• *Focuses on customer engagement every step of the way*

IMPLEMENTED CUSTOMER PROGRAMS AND NEW FUNCTIONS

• **OPOWER Web Portal fully operational** - this project provides all residential customers web access to their monthly, weekly, and hourly electric usage information from their digital meters, as well as energy saving education.

• **Distribution and Outage Management System** - GWP will work with Utility Integration Solutions, Inc. to develop a program to reduce outage recovery time and make improvements in the electric system reliability through the application of new software and intelligent devices.

• **Conservation Voltage Reduction (CVR)** - GWP will work with Dominion Voltage, Inc. to provide their EDGE solution, a conservation voltage reduction (CVR) program, as a pilot. CVR conserves electricity by operating electric customer voltages in the lower half of the ten percent (10%) voltage band required by equipment standards. Based on studies, DVI estimates that GWP should see energy savings of between 2% and 4%.

• **CEIVA Energy In-Home Displays** - GWP partnered with CEIVA Energy, LLC to provide a unique In-Home Display (IHD) solution to residential and small business customers. The CEIVA IHD is a digital picture frame that integrates customer's personal photographs with useful historical water usage information and near real time electric consumption information. The CEIVA IHD works as a home gateway that simultaneously communicates with GWP's electric digital meters as well as the customer's existing home networks via Wi–Fi or Ethernet. In addition to providing interval energy and water consumption usage information, GWP has the ability to enhance outreach, via the IHD by pushing energy efficiency program, conservation and event messages directly to the IHD. GWP is currently piloting 72 IHD's with a broad cross section of residential and small business customers. GWP plans to use data collected from the pilot to develop a utility wide program. Currently GWP expanded the pilot program to an additional 450 customers in order to gain a better under-standing of customer's usage patterns, interaction with the CEIVA in-home display that will help the utility develop a systematic utility wide program.

• **WaterSmart** - GWP will be piloting a new program similar to Opower energy reports for water consumption information. Customers will receive water usage reports that show them how much water they are using, how to conserve more and point them to the WaterSmart web portal for tips and information on conservation.

• **Mobile Application** - GWP will provide a engaging mobile application that will give customers the tools to pay their bills, report an outage, see and manage their energy usage and have direct links to support other applications such as Opower, and Water Smart.

IMPLEMENTED CUSTOMER PROGRAMS AND NEW FUNCTIONS (continued)

- **Meter Data Analytics** - GWP will work with Detectent, Inc. to provide a Meter Data Analytics Program solution. GWP believes that between 2% and 4% of its current energy losses are non-technical in nature, and can be mitigated through an effective Meter Data Analytics Program. This program will provide GWP with the ability to integrate the large amounts of customer-related data it is now receiving from various intelligent devices it has installed in the field to enhance customer program efficiencies and reduce costs.

- **Go Live with AMI** - January 2013, GWP Business Systems Support (BSS) Operations and Customer Service started reading and billing the electric and water residential and commercial meters from the AMI Itron Enterprise Edition (IEE) Meter Data Management System (MDMS). Both operations worked together to validate, reconcile, and approve each billing cycle/route by comparing the manual meter reads to the AMI Meter reading data. The results were very successful and Glendale Water and Power is reading and billing the electric and water reads from the AMI System.

- **Outstanding AMI Electric and Water Read Rates above 99.5%** – The joint collaboration of the Glendale Water and Power Business System Support (BSS) team, Customer Service, and Water and Electric Meter operations along with the City Information Services Radio Shop continued their efforts to mitigate AMI meter and back haul communication issues which greatly assisted in increasing the electric and water read rates. The upgrade to the AMI Backhaul Network, meter mitigation, and the reconciliation between the AMI systems together contributed to the outstanding read rate percentage of **99.5% and above, which is above industry standard.**

- **Customer Information System Upgrades** - The team successfully deployed version 6.4.3, maintenance release 3 (MR3) to the NorthStar Customer Information System (CIS) production environment. MR3 fixed several residual issues from the major upgrade to 6.4 and added some new field security features, set-up features, the foundation for net billing off the MDMS, and applied the platform for NorthStar's Automation Platform. The next maintenance release (MR5) will be applied to our test environment so BSS can start developing, implementing, and testing the automation platform.

- **NorthStar 6.4 Automation Platform** - is a highly configurable and powerful tool that enables users to schedule and run routine tasks on regular or event-driven bases. The Platform and Scheduler has the ability to automate and streamline business processes and will potentially free valuable staff time by automating virtually any process that a utility conducts manually-such as issuing bills, creating service orders, verifying meter data, running the nightly credit control (notice loads) and overdue interest (late fee) loads. There is also sophisticated notifications feature that further supports the Automation Platform by delivering instant messages and emails to selected users each time events created in the Automation Platform begin, end, are modified or require attention.

- **Distribution Modernization** - The 4 kV to 12 kV conversion program increases capacity of the power lines in Glendale. These increases to capacity allow more power to flow throughout the system, thereby increasing our ability to meet customer demand. The conversion replaces an aging 4,000 volt distribution system to provide a more efficient delivery of power to our customers. We recently finished a series of conversions in North Glendale and will continue upgrading distribution lines.

WHERE DO WE GO NEXT?

As GWP continues to modernize its utility and learn more about how customers are engaging and taking advantage of new tools and programs and learning more about their energy and water use, GWP will start to develop and implement new programs and services to connect and educate customers. GWP will look into partnering with new vendors that offer engaging and educating platforms that appeal to customers. Glendale Water & Power will also compare programs with other utilities and assess how different programs are implemented and adopted.

Glendale Water & Power will continue to get feedback from customers as it rolls out new programs to ensure we are meeting customers' needs. Ongoing testing and assessment will help determine whether the strategy and messages are effective and if our products and services are meeting the mark. Customer feedback is critical to developing modernized products and services that meet customer needs. Glendale Water & Power will continue to measure customers' satisfaction, continuously with the following:

– Customer interviews, surveys and focus groups for measuring consumer experience. Each method might have strengths and weaknesses, but together they help provide insight into customers.

– Customer feedback from phone calls, emails and through vendors and program implementers will be useful to redesign, alter or change programs

– Budget and schedules will be revisited to make adjustments wherever needed

Glendale Water & Power will continue to report project progress of its grant to the DOE as required. A recent DOE site assessment of our project implementation, progress, cybersecurity, risk management has met the DOE Funding Opportunity Announcement (FOA) requirements in all 15 areas. As noted in the DOE report Glendale meets all FOA requirements and has strengths in all areas such as accountability, cyber security, maintaining a chain of accountability, and policy and procedure evaluations.

CONCLUSION

The significant and sustained investment that was made to modernize our utility services will require a keen understanding by myriad stakeholders of the costs and benefits involved. Glendale Water & Power has a sound business plan for modernizing its utility with new technologies, we continue to benefit from the support of an informed and innovative thinking group of stakeholders, and we are able to adapt to the changing circumstances and evolving utility business. Glendale Water & Power has only scratched the surface of consumer awareness, education and empowerment. With a modernized utility we will now understand more of what our customers want, how to meet demand and still maintain our business integrity. Glendale Water & Power is committed to doing its part in driving this progress through its research and education program and by facilitating collaboration among stakeholders.

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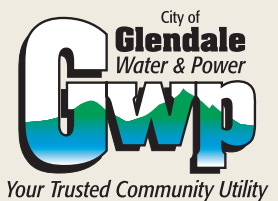
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